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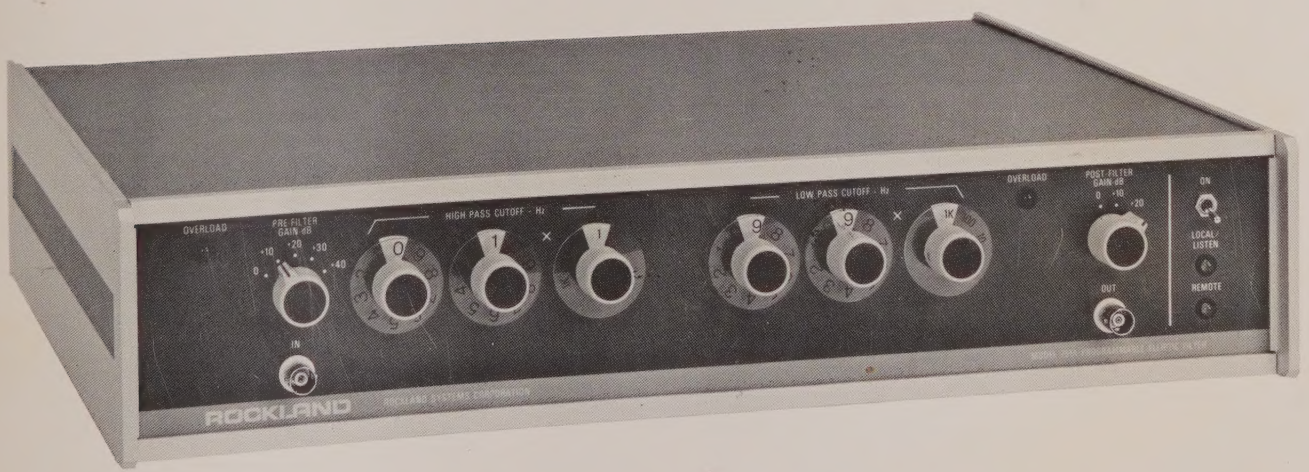
OPERATING MANUAL

WAVETEK
ROCKLAND

MODEL 751A
'BRICKWALL' FILTER



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OPERATING MANUAL

MODEL 751A

'BRICKWALL' FILTER

Manual Part Number: 800-0076

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

The Model 751A is a wide-range tunable, programmable bandpass filter with near-ideal passband and stopband characteristics. It provides independent programming of LP and HP cutoffs, allowing the user to set both center frequency and bandwidth anywhere in the operating range and it achieves an exceptionally flat passband and a remarkably high rolloff rate of better than 115 dB per octave, both above and below the selected cutoff frequencies.

The design of each of the independent (low-pass and high-pass) networks employs a 7th-order (7 poles and 6 zeros) Elliptic (Cauer) filter with design values of 0.3 dB peak-to-peak passband ripple, and 85 dB stopband attenuation above 1.7 x cutoff frequency (low pass) and below 0.6 x cutoff frequency (high pass).

The cutoff frequencies may be set from 10 Hz to 99 KHz with 2-digit resolution and 1 Hz to 9 Hz with 1-digit resolution. Overload indicators are also provided to ensure that signals being processed are at the optimum levels.

Programming of high and low cutoff frequencies, pre-filter gain are provided locally by front panel controls, and, optionally, by digital programming through a BCD parallel-input buffered interface. An IEEE Std 488 Bus Interface is also available as an option.

When used as a narrow band filter, the Model 751A is especially effective for signal-processing applications in which the spectrum of interest is considerably narrower than the total spectrum over which measurement is possible. By setting the cutoff frequencies of the Model 751A appropriately, it is possible to isolate the signals in the spectrum of interest, effectively attenuating all other frequency components. In such applications the high resolution and steep ("brickwall") rolloff provided by the Model 751A make it possible to discriminate between desired and undesired frequency components with great precision.

1-2. DESCRIPTION

ELECTRICAL. Model 751A operates from either 115 or 230 Volts ac, 48-400 Hz and consumes less than 25 Watts of power. A rear-panel slide switch selects the nominal line voltage. The case of the instrument is grounded through the power cord, while signal and digital grounds are isolated from power ground through .0l and 0.1 uF capacitor

Cutoff frequency is selected via two 10-position (0 - 9) switches and a 4-position (x1, x10, x100, x1K) multiplier switch. Pre-filter gain of 0, 10, 20, 30 or 40 dB may be selected via a 5-position switch and post-filter gain of 0, 10,or 20 dB may be selected via a 3-position switch.

MECHANICAL. The instrument cabinet is 3.5 inches high by 17 inches wide (19 inches including rack mounts) and 13 inches deep (8.9 cm x 43.2 cm x 33 cm). It weighs 18 pounds (8.2 Kg). In its standard configuration the instrument is supplied in a cabinet suitable for table-top use, with feet and tiltstand. A rack-mount conversion kit is also supplied.

The power switch, operating controls, and input and output terminals are located onthe front panel. The rear panel contains duplicate (parallel) input and output terminals, power connector, the fuse holder, the 115/230 Vac line selector switch, and, optionally the remote-program connector.

1-3. OPTIONS

The following options are available:

Option -01: BCD Interface

Option -02: IEEE 488-1978 Interface

1-4. DEFINITIONS

The important low-pass characteristic of an Elliptic Filter is illustrated in Fig. 1-1. The high-pass characteristic is the "mirror image" of the low-pass curve shown.

The Cutoff Frequency, F_c, is the frequency at which the response of the filter drops below the specified passband ripple, A_{max}. The conventional -3 dB frequency criterion has no significance in an elliptic filter.

For the low-pass section, F_s is the lowest frequency for which the specified stopband attenuation (A_{min}) applies. For the high-pass section, it is the highest frequency.

The low-pass and high-pass cutoff frequency tolerances of the Model 751A are intentionally "skewed" to beyond their nominal values. That is, the high-pass cutoff frequency is slightly lower and the low-pass cutoff frequency is slightly higher than its nominal value.

This ensures that when the two sections are set to identical cutoffs (minimum bandwidth) the slopes of the resulting response will not overlap and cause a passband amplitude loss.

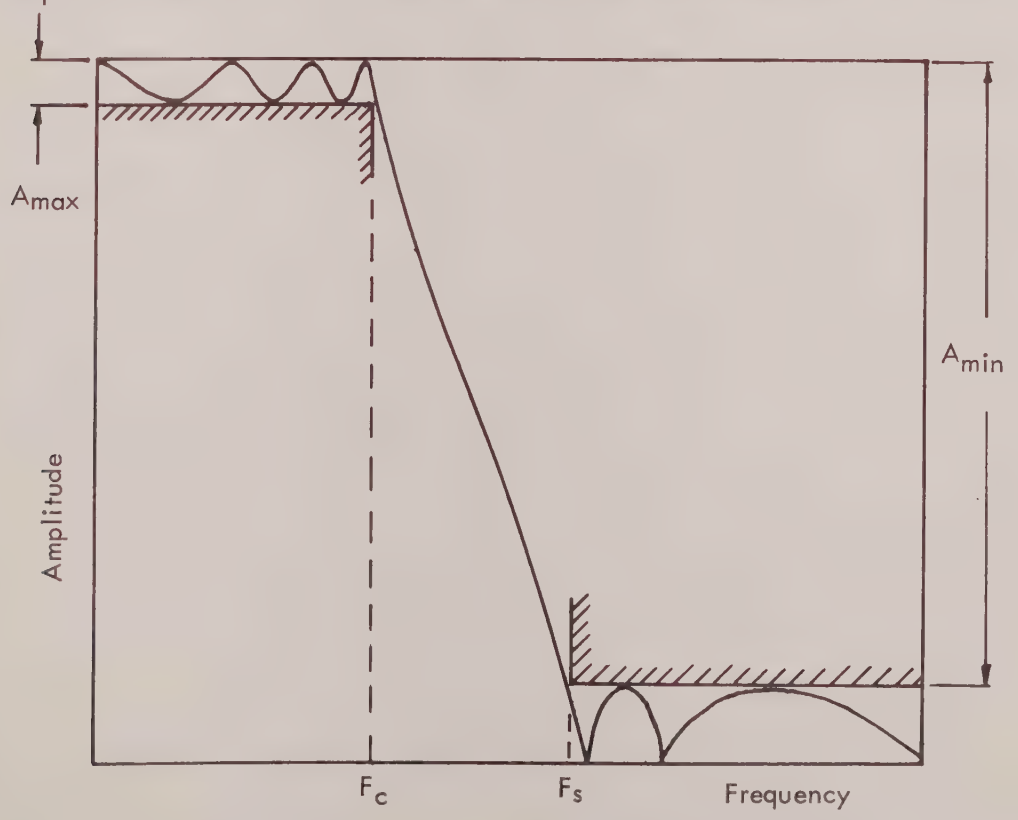


Fig. 1-1. Elliptic Filter Response

1-5. SPECIFICATIONS, MODEL 751A

FUNCTIONS	Band Pass with High Pass/Low Pass rolloffs of 115 dB/octave and individually tunable cutoff frequencies.

CUTOFF FREQUENCY

Range: High Pass and Low Pass	1 Hz - 99 KHz local and IEEE remote control 1 Hz - 100 KHz remote control (BCD) only
Programming and Resolution:	Two 10-position switches, and one 4-position multiplier switch; remotely, by 12-bit code:

Multiplier	Frequency (Hz)	Resolution (Hz)
x1	1 - 99	1
x10	100 - 990	10
x100	1K - 9.9K	100
x1K	10K - 99K	1K

Accuracy: High Pass	+0, - 2%
Low Pass	-0, + 2%
Stability:	± 200 ppm / °C

GAIN

Programming:	
Pre-filter	One 5-position switch, or 3-bit code: 0, +10, +20, +30, +40 dB
Post-filter	One 3-position switch, or 2-bit code: 0, +10, +20 dB
Accuracy, at any gain setting: (At 1KHz with High Pass at 1Hz and Low Pass at 99KHz)	± 0.2 dB

1-5. SPECIFICATIONS, MODEL 751A - continued

INPUT CHARACTERISTICS

Impedance:	1 Megohm, 50 pF, nominal
Full Scale Signal:	± 10 Volts, divided by total gain
Absolute max. Input:	± 100 Volts

FILTER CHARACTERISTICS

Passband Ripple (Amax):	< 1.2 dB, p-p Typically < 0.6dB, p-p for F_L/F_H > 10
Stopband Attenuation (Amin):	> 80 dB
F_s / F_c Ratio (See Sec. 1, 1-4):	0.6 (High Pass) 1.7 (Low Pass)

OUTPUT CHARACTERISTICS

Impedance:	50 ohms, nominal
Full Scale Signal:	± 10 Volts into $R_L \geq$ 600 ohms
Noise. Max., 1 Hz - 100 KHz: (1 MHz Detector Bandwidth) RTO at 0 dB post-filter gain RTI at max. pre-filter gain	 > 80 dB below full scale < 10 uV
Harmonic Components: (1 KHz input frequency)	> 80 dB below full scale
Intermodulation Products: (input f's: 70 KHz & 90 KHz)	> 70 dB below full scale

1-5. SPECIFICATIONS, MODEL 751A - continued

OUTPUT CHARACTERISTICS - continued

Line-related Spurious Components (Hum):	80 dB below full scale
DC Offset: max. at 25°C	0 ± 10 mV
Drift: RTO at any gain setting	1 mV / °C

REMOTE PROGRAMMING / SENSING

A. BCD Interface (Option -01)

A total of 34 bits (lines) for programming / sensing are provided as follows:

No. of Bits	Function
8 / High-Pass Section 8 / Low-Pass Section	Cutoff Frequency, Units. Selection of Cutoff Frequency units (logic 1), BCD code.
4 / High-Pass Section 4 / Low-Pass Section	Cutoff Frequency Multiplier. Selection of Cutoff Frequency Multiplier (logic 1).
3 / Pre-filter 2 / Post-filter	Gain Select. Selection of Gain setting (logic 1).
1 / High-Pass Section 1 / Low-Pass Section	Load Command. Normally held at logic 0. Logic 1 loads Cutoff Frequency and Gain data. When this control line is held at logic 1, loaded data are stored internally; programming inputs need not be held constant.

1-5. SPECIFICATIONS, MODEL 751A - continued

REMOTE PROGRAMMING / SENSING - continued

A. BCD Interface (option -01) - continued

No. of Bits	Function
1	Mode Select. Logic 1 selects remote-program control, logic 0 selects front-panel control.
1 / Pre-filter 1 / Post-filter	Sense Input Signal Overload. Logic 1 indicates an overload occured.

All input lines represent 1 standard TTL load. (TTL logic levels: logic 1 is 0.0 to + 0.8 V, logic 0 is + 2.0 to + 5.0 V). Each line is terminated with a 10 K pull-up resistor to + 5 V DC. An unconnected (open) line will assume logic (0) (high).

Programming delay is 500 usec. for any function, plus filter settling time, which is a function of the Cutoff Frequency being programmed.

B. IEEE 488 - 1978 Interface (Option -02)

Provides the following IEEE functions:

AH1:	Acceptor Hand Shake
L1 :	Basic Listener with Listen Only
DT1 :	Device Trigger
DC2:	Device Clear

Channel Select: Send "C" followed by "H" (or "A") for the high pass filter (Channel 1), "L" (or "B") for the low pass filter, or "D" for both (dual).

Cutoff Frequency Select: Send "F" followed by up to two digits between "0" and "99" for the frequency digit setting.

1-5. SPECIFICATIONS, MODEL 751A - continued

REMOTE PROGRAMMING / SENSING - continued

B. IEEE 488 - 1978 Interface (Option -02) - continued

Cutoff Frequency Multiplier Select:	Send "M" followed by an exponent digit from "0" to "3" which represents the power of ten of the multiplier (x1 to x1 K).
Gain Select:	Send "G" followed by one digit specifying gain in multiples of 10 dB. Range is "0" to "4" providing 0 to 40 dB gain for the pre-filter gain on the high pass filter and 0 to 20 dB for the post-filter gain on the low pass filter.
Loading:	All data is held in a buffer register until a Carriage Return or Group Execute Trigger is issued.
Address Selection:	Rear Panel switches.

GENERAL

Power Requirements:	115 / 230 Vac ± 10%, 48 - 400 Hz, 25 Watts
Operating Temperature:	0°C to + 50°C
Storage Temperature:	- 20°C to + 70°C
Dimensions:	3.5" H x 17" W x 13" D (8.9 cm x 43.2 cm x 33 cm)
Weight:	18 pounds (8.2 Kg) net, 23 pounds (10.5 Kg) shipping
Configuration:	Bench-Top, convertible to rack-mount
Input/Output Connectors:	BNC's on front and rear panel
Accessories Supplied:	Operating and Service Manual, Rack Mounting Kit

SECTION II

OPERATION

2-1. INTRODUCTION

The instrument is electrically operational as shipped from the factory. The following paragraphs describe inspection, power requirements, interconnection, and operation.

2-2. INSPECTION

This instrument was carefully inspected and tested prior to shipment. It was operated for a number of hours to reduce the probability of early failure. After unpacking the unit, inspect it carefully for shipping damage. Check especially for broken controls and connectors, and dented or scratched cabinet parts. Should the instrument show any signs of damage, file a claim with the carrier immediately. Preserve the carton and packing materials; they will be required by the carrier.

It is recommended that conformance to specifications be verified upon receipt. In case of discrepancies, refer to the warranty at the beginning of this manual.

2-3. INSTALLATION AND POWER REQUIREMENTS

The Model 751A is designed for table-top operation or installation in a standard 19-inch RETMA rack. Ambient temperature within the rack must not exceed + 50°C while the instrument is operating. Other paragraphs in this section describe connections and switch settings which should be made before the unit is installed.

2-3. INSTALLATION AND POWER REQUIREMENTS - continued

CAUTION
Always ensure that the 115/230 Volt switch is set for the nominal line voltage and that a fuse of the proper rating is installed in the instrument. If the switch is set incorrectly or a fuse of the wrong rating is used, the instrument may be damaged or fail to operate.

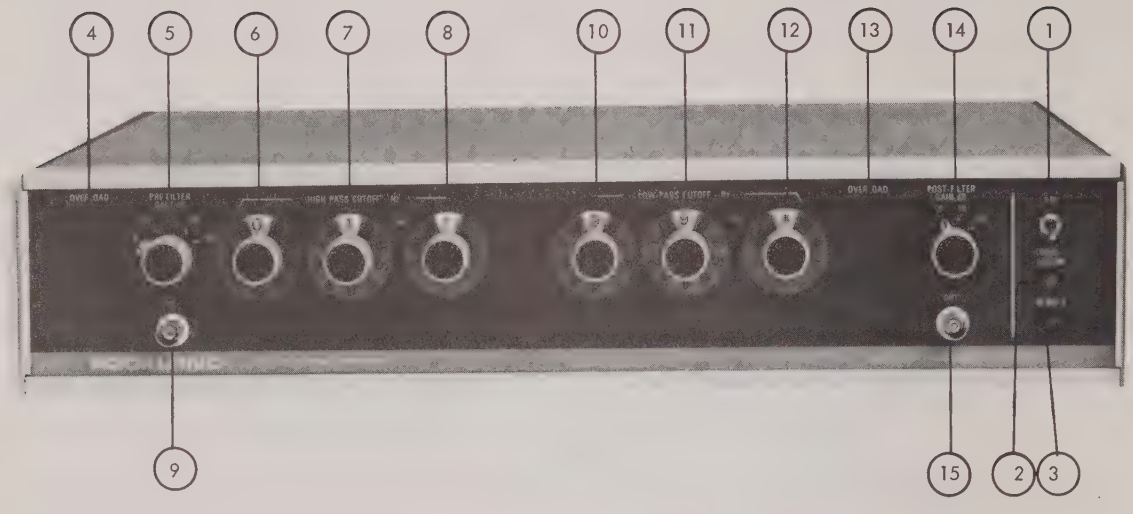
The instrument will operate from either 115 or 230 V ac ± 10%, 48-400 Hz. Conversion for line voltage is performed with a slide switch mounted on the rear panel (see Fig. 2-1). The unit is shipped with the switch set for 115 Volts. To change the setting, insert a small-blade screwdriver in the switch slot and move switch to expose 115 for 115 V ac operation, or 230 for 230 V ac operation.

The instrument is shipped with a 1-Amp slow-blow fuse for 115 Volt or 230 Volt operation.

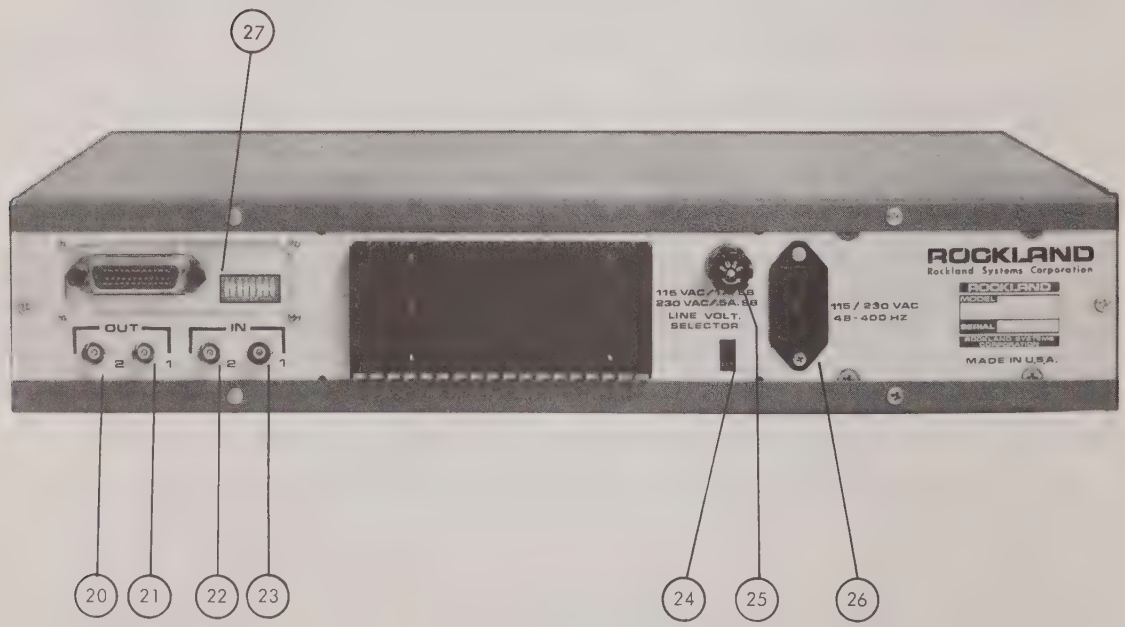
WARNING
In keeping with standard safety practice, the case of the instrument is grounded through the power cord. If the instrument must be connected to a two-wire receptacle, use a parallel-ground adapter and connect the short lead to ground.

2-4. CONTROLS AND INDICATORS

Controls and indicators are shown in Fig. 2-1 and described in Table 2-1.



FRONT PANEL



REAR PANEL

Fig. 2-1. Controls and Indicators

NUMBER	DESCRIPTION
1	ON Switch: The switch is moved to the ON position to supply power to the instrument.
2	LOCAL/LISTEN light emitting diode (LED) is lit when the front panel controls are active (LOCAL) or when the instrument is under remote control, using the IEEE 488-1978 interface, and in the LISTEN mode. With the BCD interface it will not be lit in the remote mode.
3	REMOTE LED is lit when the instrument is in the remote mode.
4	OVERLOAD LED is lit when the amplitude of the input signal exceeds the maximum desirable amplitude. (See paragraph 2-5).
5	PRE-FILTER GAIN Switch has 5 positions, for setting gain from 0 dB to 40 dB in 10 dB steps.
6	First significant digit of high-pass cutoff frequency setting, positions 0 - 9, continuous rotation.
7	Second significant digit of high-pass cutoff frequency setting, positions 0 - 9, continuous rotation.
8	Decimal multiplier of high-pass cutoff frequency, 4 positions.
9	Input BNC Connector (Floating).
10	First significant digit of low-pass cutoff frequency setting, positions 0 - 9, continuous rotation.
11	Second significant digit of low-pass cutoff frequency setting, positions 0 - 9, continuous rotation.
12	Decimal multiplier of low-pass cutoff frequency, 4 positions.
13	OVERLOAD LED is lit when the amplitude of the output signal exceeds the maximum desirable amplitude (See paragraph 2-5).
14	POST-FILTER GAIN has 3 positions for setting gain from 0 dB to 20 dB in 10 dB steps.
15	Output BNC Connector.
20	Output BNC Connector.
21	Duplicate Output BNC Connector.
22	Input BNC Connector.
23	Duplicate Input BNC Connector.
24	115/230 V line voltage selector switch.
25	Fuseholder for slow-blow fuse.
26	3-wire AC power connector.
27	Programming connector is mounted through the rear panel. Option -01, BCD interface, uses a 50-pin connector. (Table 2-2 describes the function associated with each pin). IEEE bus interface, uses a connector meeting the requirements of the IEEE STD 488-1978. Also, a rocker switch on the rear panel provides for device address code selection using a 5-bit binary code.

TABLE 2-1
CONTROLS AND INDICATORS

2-5. TYPICAL OPERATING PROCEDURES

a. Passband

The passband of the filter extends from the High-Pass Cutoff Frequency setting to the Low-Pass Cutoff Frequency setting. These, in turn, are determined by the two Cutoff Frequency dials and the corresponding Multiplier switches.

Always select the minimum Multiplier setting. For example, a cutoff frequency of 90 Hz can be set as 09 x 10 or 90 x 1. The proper choice is 90 x 1. Another way of stating this requirement is that the first significant digit of the cutoff frequency dials should not be set to 0, except when the desired cutoff frequency is less than 10 Hz. The minimum valid setting of Cutoff Frequency dials is 01. The setting 00 is not valid.

The narrowest passband is obtained by setting High-Pass and Low-Pass cutoff frequencies to the same value f_o. In this case, the insertion loss is nominally 0 dB; the 3 dB bandwidth extends from approximately 0.95 f_o to approximately 1.05 f_o and it is equal to 0.1 f_o. This corresponds to a Q of 10. In this mode of operation, the instrument operates as a constant -Q, or constant % - Bandwidth filter.

b. Pre-Filter Gain

Pre-Filter Gain may be selected to be 0, 10, 20, 30 or 40 dB. To maximize the useful dynamic range, the maximum gain should be used without causing the corresponding OVERLOAD LED to light.OVERLOAD"On" indicates that an input signal has exceeded the maximum safe desirable amplitude. If the signal exceeds this range and its frequency is within the passband of the filter, a ± 10 Volt A/D converter connected to the output of the 751A will overflow; however, no distortion occurs in the instrument until the signal exceeds full-scale by 10%.

The maximum desirable full-scale signal is ± 10 V (7.1 V rms) for 0 dB gain. When Pre-Filter Gain is employed, the maximum input signal decreases in direct proportion to the increase in gain. For example, with 20 dB gain, the maximum desirable input amplitude is ± 1.0 V (0.71 V rms).

2-5. TYPICAL OPERATING PROCEDURES - continued

c. Post-Filter Gain

Post-Filter Gain may be selected to be 0, 10 or 20 dB. This control should be set such that it does not cause the corresponding OVERLOAD LED to light. OVERLOAD "On" indicates that the output signal has exceeded the maximum safe desirable amplitude and a ± 10 Volt A/D converter connected to the output of the 751A will overflow; however, no distortion occurs in the instrument until the signal exceeds full-scale by 10%.

When Post-Filter gain other than 0 dB is used, the dynamic range of the instrument is reduced by the amount of gain employed.

The primary use of Post-Filter gain is when the instrument is being used with small (narrow) passbands; it may be used to increase the amplitude of a small signal which was buried in broadband noise; or, it may be used to amplify noise, when the objective is to generate band-limited noise from a broadband noise source.

2-6. PROGRAMMING: BCD INTERFACE - (OPTION -01)

A 50-pin connector is provided in the rear panel. Table 2-2 lists the pin connections and describes each signal. Remote programming inputs are low active ("1" State). A "1" is 0 V to 0.8 V, and a "0" is + 2 V to + 5 V.

TABLE 2-2

BCD INTERFACE PROGRAMMING CONNECTOR

PIN	FUNCTION	DESCRIPTION
1	x1 Cutoff-Frequency Multiplier	Low active. Selects the cutoff-frequency multiplier for Channel 1 (high pass channel).
2	x10 Cutoff-Frequency Multiplier	
3	x100 Cutoff-Frequency Multiplier	
4	x1K Cutoff-Frequency Multiplier	
5	Cutoff-Frequency 1	Low active. Selects the units digit for the cutoff-frequency for Channel 1 in 8-4-2-1 binary code.
6	Cutoff-Frequency 2	
7	Cutoff-Frequency 4	
8	Cutoff-Frequency 8	
9	Cutoff-Frequency 10	Low active. Selects the tens digit for the cutoff-frequency for Channel 1 in 8-4-2-1 binary code.
10	Cutoff-Frequency 20	
11	Cutoff-Frequency 40	
12	Cutoff-Frequency 80	
13	Gain 1	Low active. Selects the gain setting for Channel 1 in 4-2-1 binary code. 0 dB corresponds to 000, 10 dB to 001, 20 dB to 010, 30 dB to 011 and 40 dB to 100.
14	Gain 2	
15	Gain 4	
16	Overload	Low active. Indicates amplitude of input signal exceeds the maximum desirable value in Channel 1.
17-22	Ground	
23	Load Command	Low active. Loads cutoff-frequency and gain into the digital registers of Channel 1.
24	Ground	
25-26	Remote Enable	Low active. Disables front panel control of both Channels and enables remote control.
27	Ground	

TABLE 2-2 - continued

PIN	FUNCTION	DESCRIPTION
28	Load Command	Low active. Loads cutoff-frequency and gain into the digital registers of Channel 2 (low pass channel).
29-34	Ground	
35	Overload	Low active. Indicates amplitude of the signal exceeds the maximum desirable value out of Channel 2.
36		Not used.
37 38	Gain 2 Gain 1	Low active. Selects the gain setting for Channel 2 in 2-1 binary code. 0 dB corresponds to 000, 10 dB to 001, 20 dB to 010.
39 40 41 42	Cutoff-Frequency 80 Cutoff-Frequency 40 Cutoff-Frequency 20 Cutoff-Frequency 10	Low active. Selects the tens digit for the cutoff-frequency for Channel 2 in 8-4-2-1 binary code.
43 44 45 46	Cutoff-Frequency 8 Cutoff-Frequency 4 Cutoff-Frequency 2 Cutoff-Frequency 1	Low active. Selects the units digit for the cutoff-frequency for Channel 2 in 8-4-2-1 binary code.
47 48 49 50	x1K Cutoff-Frequency Multiplier x100 Cutoff-Frequency Multiplier x10 Cutoff-Frequency Multiplier x1 Cutoff-Frequency Multiplier	Low active. Selects cutoff-frequency multiplier for Channel 2.

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02)

2-7-1. Introduction

The reader is assumed to be familiar with the conventions of the IEEE 488-1978 standard digital interface. If not, a detailed description of the bus system and all its parameters, IEEE STD 488-1978 is available from:

IEEE Standards
347 East 47th Street
New York, New York 10017

The general principles for operating in a generalized system are discussed below.

2-7-2. Device Address Code and Mode Select Switches

The row of eight miniature rocker switches on the rear panel are used to set the device address code and other operating modes.

2-7-3. Device Address Code Selection - Switches # 1 through # 5

The five left-most switches allow the selection of the device address in the system. The range of addresses is from 0 to 30 (decimal) corresponding to the ASCII characters "SPACE" through " ".

The switches have binary weights of "1", "2", "4", "8" and "16". When the top edge of the rocker is depressed, the binary weight of that switch contributes to the address. When the bottom edge of the rocker is depressed, that weight is off. For example, to set a listen address of 11 (decimal), the rocker switch pattern would be (left-to-right) on-on-off-on-off, or up-up-down-up-down.

2-7-4. Listen Always (Listen Only) Mode - Switch #7

The LISTEN ALWAYS (or LISTEN ONLY) mode allows the Model 751A to behave as if it were always in the addressed listener mode. This eliminates the necessity for explicitly addressing the unit as a listener in simpler systems. When the LISTEN ALWAYS rocker switch is in the up (top depressed) position the LISTEN ALWAYS (LISTEN ONLY) mode is selected. When this rocker switch is down (bottom depressed), the unit must be explicitly made a listener to receive data.

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-5. Shield Ground - Switch #8

When this switch is in the up position the shield of the IEEE Bus cable is electrically connected to the circuit ground of the Model 751A. When the switch is in the down position, the shield is not connected to the Model 751A.

Use of this switch may be necessary in achieving optimum noise performance in a multi-instrument system.

2-7-6. Initialization

After power has been applied to all devices in the system, the Controller should:

1. Send REM (Remote Enable) active (low)
2. Send IFC (Interface Clear) active (low)
3. Send IFC (Interface Clear) inactive (high)

This will initialize all bus devices and set them to an idle state. Exercizing the IFC line as above is also useful in reinitializing the system whenever it may be necessary. The Model 751A will assume the UNLISTEN state after this sequence.

2-7-7. Listen State

In order to receive data, the Model 751A must be in the LISTEN state, indicated by the green lamp on the front panel. When in the LISTEN state, the unit will handshake and inspect all data sent over the bus. When not in the LISTEN state, the unit does not participate in the handshake and will ignore data. Two methods are available for effecting the LISTEN state:

1. Sending the LISTEN command
2. Setting the LISTEN ALWAYS switch ON

a. LISTEN Command

The LISTEN command is a universal bus command sent by the Controller containing the address of the device to be affected. After sending this command, the green LISTEN lamp on the front panel of the Model 751A should be lit.

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-7. Listen State - continued

b. LISTEN ALWAYS

If the rear panel LISTEN ALWAYS switch is set ON, then the first prefix character handshake cycle on the bus will place the Model 751A in the LISTEN mode, lighting the green LISTEN lamp.

c. UNLISTEN STATE

If the LISTEN ALWAYS switch if OFF, the Model 751A will leave the LISTEN state if the universal command UNLISTEN or IFC is issued or if power is removed. If the LISTEN ALWAYS switch is ON, the Model 751A will leave the listen state only if power is removed or IFC is issued.

2-7-8. Sending Data

All control and input data are sent in ASCII character format, which is prevalent in IEEE Bus systems.

When in the LISTEN mode, the Model 751A will handshake all characters sent over the bus, but only some of them are meaningful to its operation. Below is a list of such meaningful or "key" characters:

"H" or "A"	Code for Channel 1 (High Pass Section)
"L" or "B"	Code for Channel 2 (Low Pass Section)
"D"	Code for both Channels
"G"	Gain Digit Prefix
"0" through "9"	Data Value
"F"	Cutoff-Frequency Digit Prefix
"M"	Cutoff-Frequency Multiplier Prefix
"C" or "S"	Channel Select Prefix
"CR"	Carriage Return for Loading
"GET"	Group Execute Trigger for Loading

If any characters other than these are sent, the Model 751A will ignore them.

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-8. Sending Data - continued

a. Channel Select Commands

To select which filter channel is to be loaded, the character "C" must be sent followed by either:

H or A for Channel 1
L or B for Channel 2
D for both Channels

For example, to select Channel 1 send:

"CH" or "CA"

In order to make the string more intelligible to the user, extra non-"key" characters may be inserted:

"CH : H" or "CH : A"
"CHNL = H" or "CHNL = A"

b. Frequency Digit Commands

The frequency digit is loaded by sending "F" followed by up to two digits within the range of 0 to 99. For example, to send a frequency digit of 6, send:

"F6"

By inserting extra non-"key" characters, the string can be more readable:

"FREQ = 6"
"FREQ DIGIT : 6"

Notice that both of these last examples contain the same "key" characters, "F6". The other characters are simply ignored.

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-8. Sending Data - continued

b. Frequency Digit Commands - continued

If more than two digits are sent, only the last two will be retained.

> It is advisable never to send a frequency digit of "0" since this will cause a large DC offset to appear at the filter outputs.

c. Frequency Multiplier Commands

The frequency multiplier is treated like an exponent of 10. To enter the multiplier, send "M" followed by one digit from 0 to 3 which represents the power of ten of the multiplier. For example, "M3" corresponds to a multiplier of setting x 1 K.

Any digit greater than "3" will be ignored and not loaded and if more than one digit is entered, only the last one will be retained if it is "3" or less.

By adding non-"key" characters, alternate strings may be issued:

"MULT = 3"
"MULT RNGE : 3"

d. Gain Commands

The pre-filter gain, located on Channel 1 is loaded by sending "G" followed by 1 digit between 0 and 4 specifying the gain in multiples of 10 dB. For example, to set a maximum gain of 40 dB send:

"G4"

By inserting extra non-"key" characters, the string can be more readable:

"GAIN = 4"
"GAIN : 4"

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-8. Sending Data - continued

d. Gain Command - continued

Notice that all these examples contain the same "key" characters "G4" The other characters are ignored.

The post-filter gain on Channel 2 has a maximum gain of 20 dB corresponding to code "G2".

e. Loading Commands - "CR" and "GET"

In order to cause the external data to be transferred into the Model 751A either a "CR" (Carriage Return) or "GET" (Group Execute Trigger) command is required. When either of these characters is received, the interface generates a LOAD command to the 751A.

The termination of a digit value following a prefix character ("C", "F", "M", or "G") is accomplished by sending another prefix character or a "CR" or "GET" command.

The "GET" command is a universal command which is sent by the Controller. Most IEEE Bus systems use this command to initiate an activity in more than one bus device simultaneously. The interface interprets the "GET" command exactly as a "CR" character, causing loading of the digit data to Model 751A.

f. Combining Commands

Channel number, and gain commands may be entered in one ASCII string followed by a "CR" or "GET" which transfers all data simultaneously to the unit. The order of command is unimportant. If one or more of the commands is omitted, the last value entered will be retained (as long as power is maintained). If more than one occurrence of a command is present in a string, only the last one will be retained.

For example, to program Channel 2 with 60 KHz cutoff-frequency and 10 dB gain send:

"CLF60M3G1 (CR)"

2-7. PROGRAMMING: IEEE INTERFACE - (OPTION -02) - continued

2-7-8. Sending Data - continued

f. Combining Commands - continued

Alternatives, showing that order is unimportant, are:

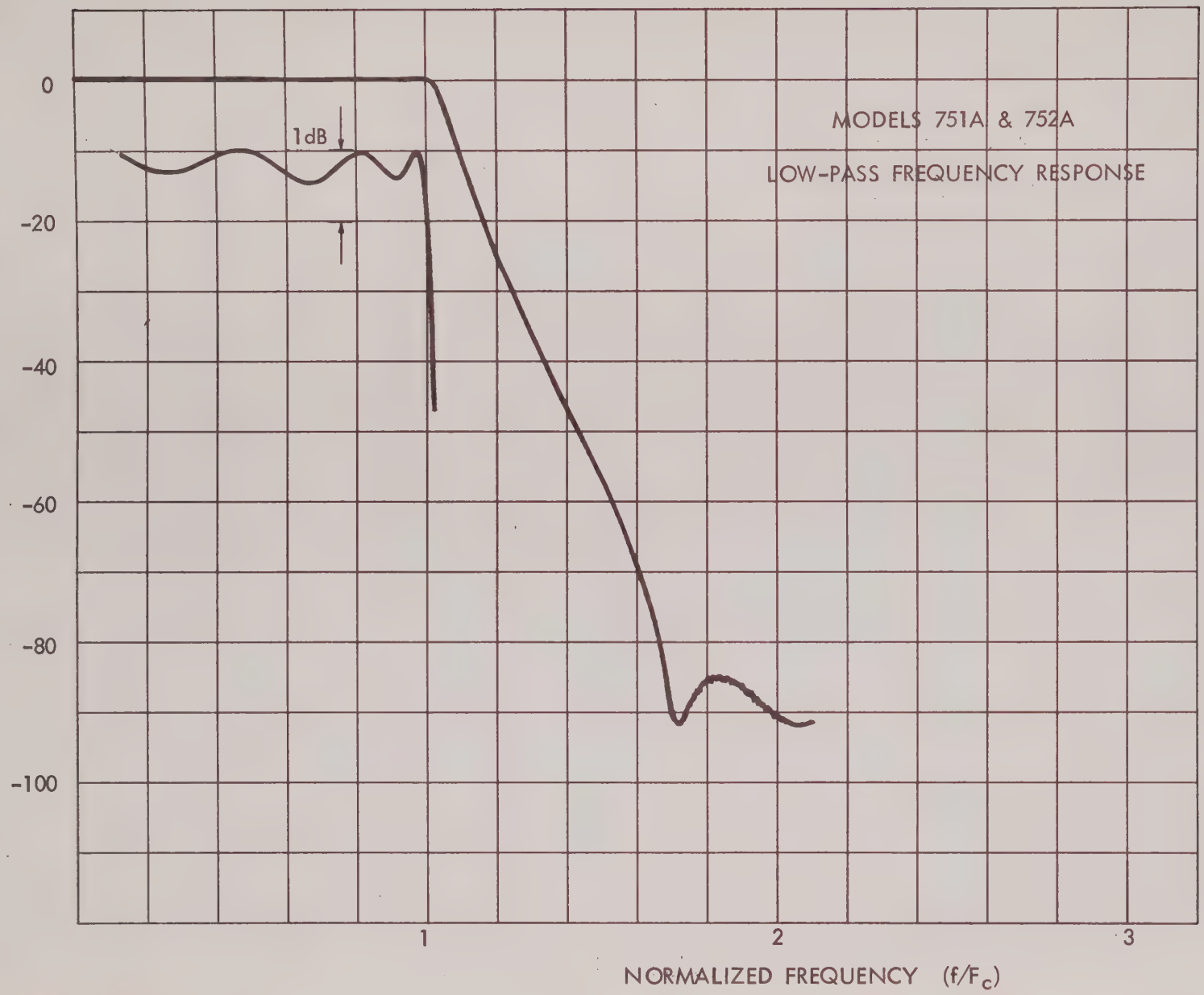
"F60M3G1CL (CR)"
"M3CLG1F60 (CR)"

In addition, if the channel select, multiplier digit, and gain do not change from the previous entry but the frequency digit changes to 40, then it is only necessary to send:

"F40 (CR)"

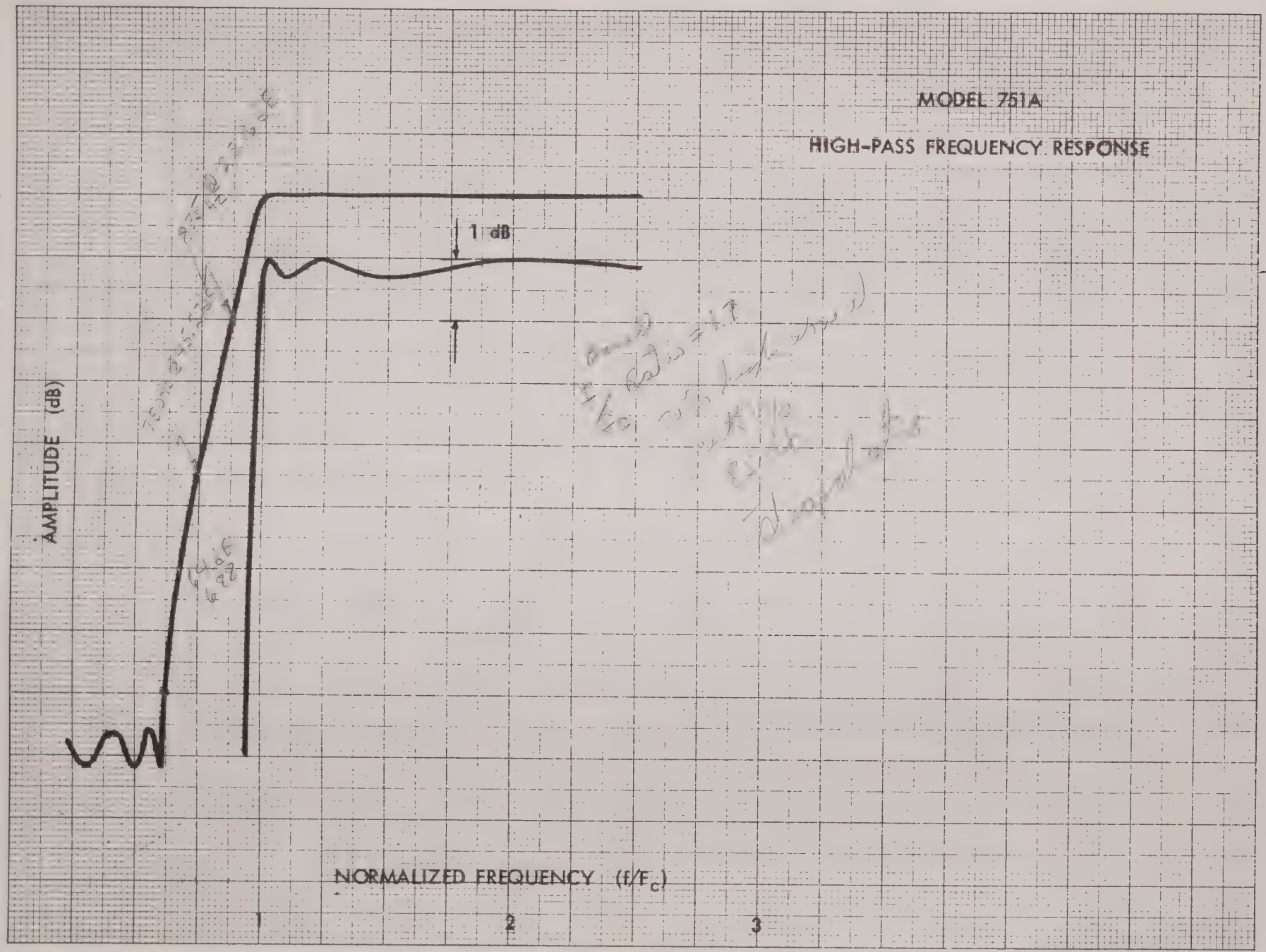
Extra non-"key" characters may be included for easier programming:

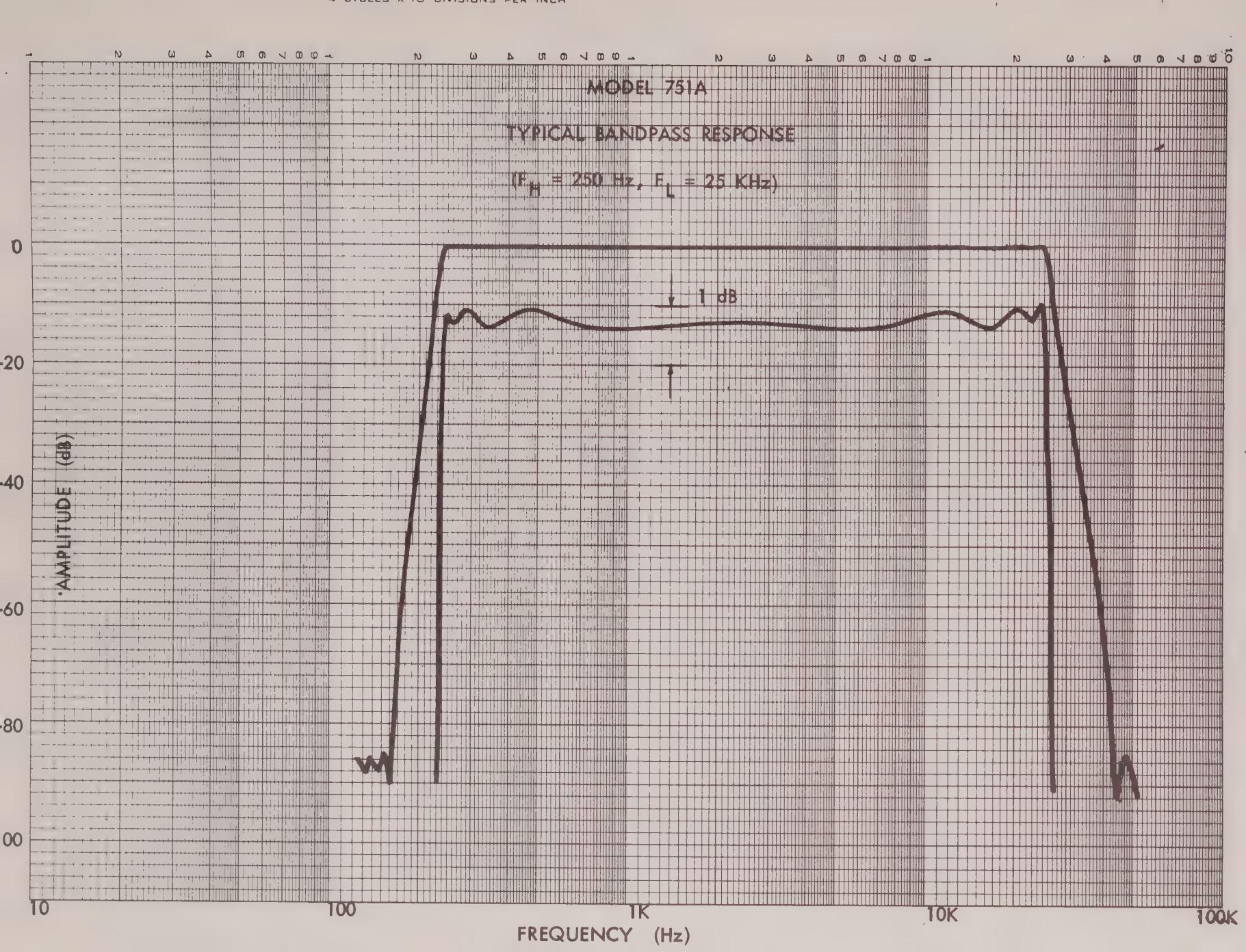
"CHNL = L, FREQ = 60, MULT = 3, GAIN = 1 (CR)"

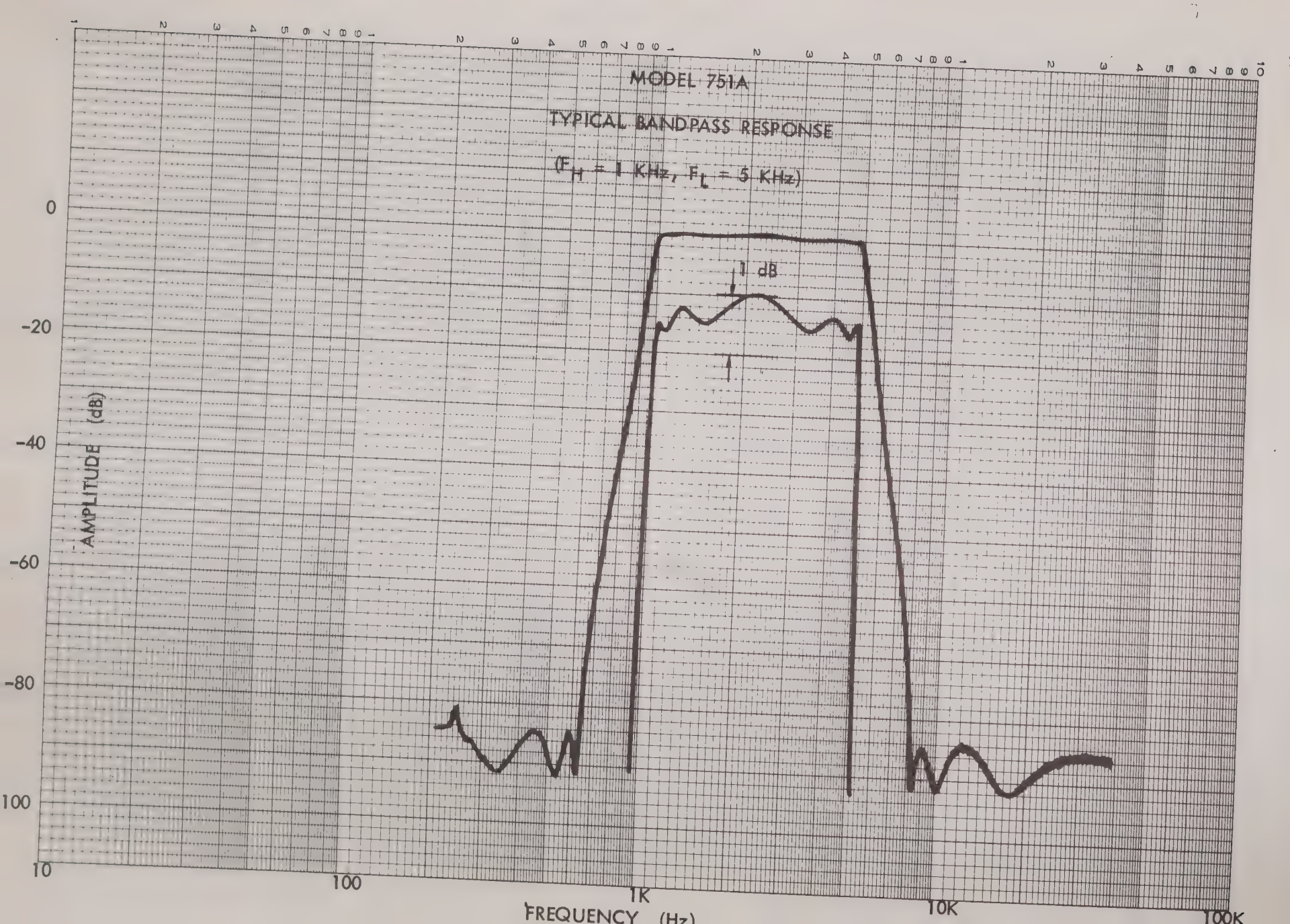

MODELS 751A & 752A
LOW-PASS FREQUENCY RESPONSE
1dB
0
-20
-40
-60
-80
-100
AMPLITUDE (dB)
1
2
3
NORMALIZED FREQUENCY (f/Fc)

MODEL 751A

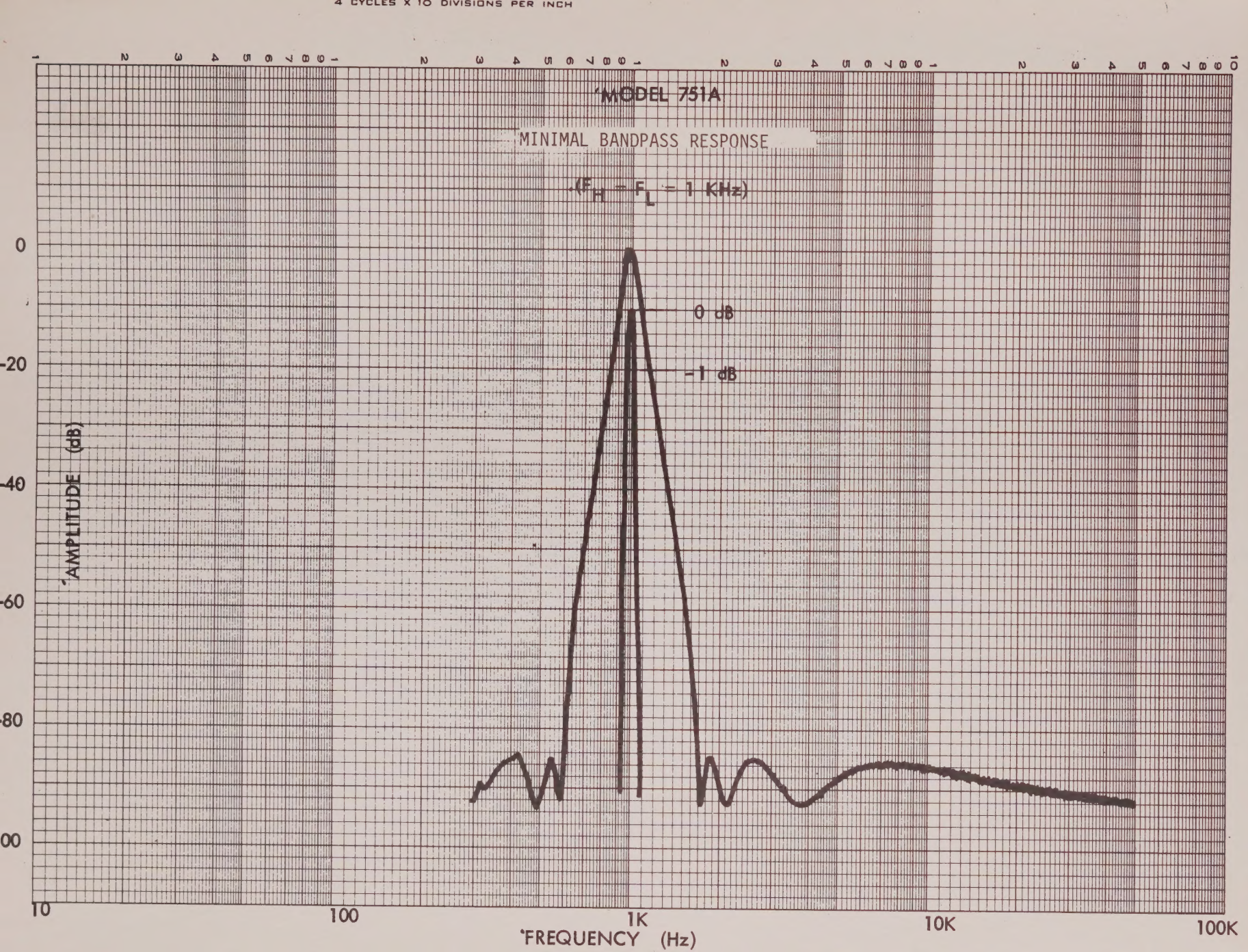
HIGH-PASS FREQUENCY RESPONSE




MODEL 751A
TYPICAL BANDPASS RESPONSE
(F_H = 250 Hz, F_L = 25 KHz)
1 dB
0
-20
-40
-60
-80
00
AMPLITUDE (dB)
10
100
1K
10K
100K
FREQUENCY (Hz)


MODEL 751A
TYPICAL BANDPASS RESPONSE
(F_H = 1 KHz, F_L = 5 KHz)
1 dB
0
-20
-40
-60
-80
-100
AMPLITUDE (dB)
10
100
1K
10K
100K
FREQUENCY (Hz)

4 CYCLES X 10 DIVISIONS PER INCH



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